

## REMARKS

Reconsideration and allowance of this application are respectfully requested in light of the above amendments and the following remarks.

The abstract has been amended to comply with US practice, and to correct an obvious error that would have been recognized by one of ordinary skill in the art. Support for the error correction is explained in more detail below.

The specification has been amended to correct minor typographical errors and errors that would be obvious to one of ordinary skill in the art. As discussed in detail below, support for the amendments is provided, for example, in paragraphs [0066]-[0069] and [0092]-[0093] of the published specification. No new matter has been entered.

Claims 1, 4, 6, and 8-12 were rejected, under 35 USC 112, first paragraph, as failing to comply with the written description requirement. As noted below, the limitation of "a symbol frequency", added by the amendment filed on January 21, 2011 in independent claims 1 and 4 and dependent claims 6, 8, 9 and 11, has clear support in the Applicants' original disclosure.

More specifically, in paragraphs [0106] and [0107] the original specification recited that "carrier frequencies in SSB modulators 110 and 120 are provided with a difference by a frequency corresponding to the reciprocal of the symbol rate (i.e. fundamental frequency of the input symbol)." The error in this recitation would be obvious to a person skilled in the art because, expressed as an equation, this recitation would produce the relationship: Reciprocal of Symbol Rate (seconds/symbols) = Fundamental Frequency (1/seconds). As evident from the equation, the relation of units for this equation would be clearly erroneous since it would provide (seconds/symbols) = (1/seconds). Thus, a skilled artisan reading the original specification would

recognize the error in the original specification. Further, the person also would recognize that the recitation of “reciprocal of the symbol rate” should in fact be “the symbol frequency” based on, for example, paragraphs [0066]-[0069] and [0092]-[0093] of the published specification.

Paragraph [0066] states: “Multiplier 113 multiplies the Nyquist signal of Bit1, 3 input to frequency-increasing SSB modulator 110 by a cosine curve, from frequency signal source 112, with frequency  $\omega_1 - \omega_0/2$  obtained by subtracting a half the symbol frequency  $\omega_0$  from carrier frequency  $\omega_1$ . At the same time, multiplier 114 multiplies a signal obtained by passing the Nyquist signal of Bit1, 3 through Hilbert transformer 111 by a sine curve with the frequency  $\omega_1 - \omega_0/2$  from frequency signal source 112. Adder 115 calculates the sum of these two outputs, and an upper SSB signal (USB signal) is obtained which conveys the signal Bit1, 3 and has the carrier frequency  $\omega_1 - \omega_0/2$ .” (Emphasis added.)

Paragraph [0067] states: “Meanwhile, multiplier 124 multiplies the Nyquist signal of Bit2, 4 input to frequency-increasing SSB modulator 120 by a cosine curve, from frequency signal source 122, with frequency  $\omega_1 + \omega_0/2$  obtained by adding a half the symbol frequency  $\omega_0$  to carrier frequency  $\omega_1$ . At the same time, multiplier 123 multiplies a signal obtained by passing the Nyquist signal of Bit2, 4 through Hilbert transformer 121 by a sine curve with the frequency  $\omega_1 + \omega_0/2$  from frequency signal source 122. Adder 125 calculates the sum of these two outputs, and a lower SSB signal (LSB signal) is obtained which conveys the signal Bit2, 4 and has the carrier frequency  $\omega_1 + \omega_0/2$ .” (Emphasis added.)

Paragraph [0068] states: “Then, signal combiner 130 combines the USB signal (see FIG. 6A) output from frequency-increasing SSB modulator 110 and the LSB signal (FIG. 6B) output

from frequency-increasing SSB modulator 120, thereby obtaining a SSB-multiplexed modulation signal as shown in FIG. 6C.”

Paragraph [0069] states: “Thus, in this Embodiment, frequency-increasing SSB modulator 120 to obtain a LSB signal performs SSB modulation using a carrier frequency higher than a carrier frequency used in frequency-increasing SSB modulator 110 to obtain a USB signal by the fundamental frequency of an input symbol. It is thereby possible to multiplex the LSB signal and USB signal in the same frequency bandwidth.” (Emphasis added.)

Paragraph [0092] states: “Frequency-decreasing demodulator 310 has a demodulator comprised of frequency signal source 313 and multiplier 311. Frequency-decreasing demodulator 310 multiplies in multiplier 311 the input signal by a cosine curve, from frequency signal source 313, with the frequency  $\omega_1 - \omega_0/2$  obtained by subtracting a half the symbol frequency  $\omega_0$  from the carrier frequency  $\omega_1$ . Passing the output through Nyquist filter (NFL) 330 obtains the original signal Bit1, 3. (Emphasis added.)

Paragraph [0093] states: “Frequency-decreasing demodulator 320 has a demodulator comprised of frequency signal source 322 and multiplier 321. Frequency-decreasing SSB demodulator 320 multiplies in multiplier 321 the input signal by a cosine curve, from frequency signal source 322, with the frequency  $\omega_1 + \omega_0/2$  obtained by adding a half the symbol frequency  $\omega_0$  to the carrier frequency  $\omega_1$ . Passing the output through Nyquist filter (NFL) 331 obtains the original signal Bit2, 4.” (Emphasis added.)

As evident from the above discussion, a person of ordinary skill in the art reading the original specification would recognize that the recitation of “reciprocal of the symbol rate” in

paragraphs [0106] and [0107] is an error since it would lead to a clearly erroneous mathematical relationship, and that the recitation in fact should be “the symbol frequency.”

For the reasons discussed above, it is respectfully submitted that the rejection of claims 1, 4, 6, and 8-12 under 35 USC 112, first paragraph, should be withdrawn.

Claims 1, 4, 6, and 8 were rejected, under 35 USC §103(a), as being unpatentable over Daoud (US 4,835,791) in view of Muzzi (US 3,628,155). Claims 2, 3 and 5 stand withdrawn from consideration as being directed toward non-elected subject matter. (It should be noted that references herein to the specification and drawings are for illustrative purposes only and are not intended to limit the scope of the invention to the referenced embodiments.)

Claim 1 defines:

*A modulation apparatus comprising:  
a first frequency-increasing single side band (SSB) modulator that performs SSB modulation on a first input symbol to obtain an upper side band (USB) signal;  
a second frequency-increasing SSB modulator that performs the SSB modulation on a second input symbol to obtain a lower side band (LSB) signal;  
and  
a combiner that combines the USB signal and the LSB signal,  
wherein the second frequency-increasing SSB modulator performs SSB modulation to obtain the LSB signal using a carrier frequency, the carrier frequency being higher than a carrier frequency used in the first frequency-increasing SSB modulator by a symbol frequency of the first input symbol and the second input symbol, such that the LSB signal and the USB signal are multiplexed in the same frequency band. (Emphasis added.)*

Thus, claim 1 provides a modulation apparatus that performs single side band (SSB) modulation to obtain a lower side band (LSB) signal using a carrier frequency that is higher, by the fundamental frequency of an input symbol, than a carrier frequency that is used to obtain an

upper side band (USB) signal, such that the LSB signal and USB signal are multiplexed in the same frequency band.

The Office Action proposes that Daoud discloses, in col. 4, lines 38-49, the Applicants' claimed symbol frequency, stating that "200Hz frequency gap [is] interpreted to be a symbol frequency." See Office Action pages 5-6.

However, "the symbol frequency" as recited in the claims is a technically-defined term and means a frequency at which a modulation wave changes. Daoud discloses that the 200 Hz difference between carrier frequencies used to generate LSB and USB signals is selected to prevent cross-talk in a telephone line channel while not significantly detracting from the usable bandwidth (i.e., 200-3400 Hz) of the channel (see Daoud col. 1, lines 26-29, and col. 4, lines 38-49).

Thus, Daoud's disclosed difference of 200 Hz between carrier frequencies used to generate the LSB and USB signals is not the same as, and does not take into consideration, the symbol frequency of the input signal to the LSB and USB modulators. Therefore, it naturally follows that Daoud does not disclose the feature of "wherein the second frequency-increasing SSB modulator performs SSB modulation to obtain the LSB signal using a carrier frequency, the carrier frequency being higher than a carrier frequency used in the first frequency-increasing SSB modulator by a symbol frequency of the first input symbol and the second input symbol, such that the LSB signal and the USB signal are multiplexed in the same frequency band," as recited by claim 1. Muzzi does not supplement the teachings of Daoud in this regard.

Accordingly, the Applicants submit that the teachings of Daoud and Muzzi, even if combined as proposed in the Office Action, still would lack the above-noted subject matter of

claim 1 and thus these references, considered individually or in combination, do not render obvious the subject matter defined by claim 1. Claim 4 similarly recites the above-mentioned subject matter distinguishing apparatus claim 1 from the applied references, but with respect to a method. Therefore, allowance of claims 1 and 4 and all claims dependent therefrom is warranted.

Applicants note that, on pages 8-9 in the previous Amendment filed on January 21, 2011, the Applicants submitted an argument that new claims 9-12 are patentable over Daoud and Muzzi. However, the current Office Action fails to provide a response to the argument. It is respectfully noted that the Office is required to answer the substance of this argument. See MPEP 707.07(f) (noting: "Where the applicant traverses any rejection, the examiner should, if he or she repeats the rejection, take note of the applicant's argument and answer the substance of it."). Accordingly, the Applicants respectfully request that, in the next Action, the Office should answer the substance of this argument, if the Office disagrees with the argument.

In view of the above, it is submitted that this application is in condition for allowance, and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

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